

In the Claims.

1. – 76. (Cancelled.)

77. (Currently amended.) A process for the production of purified biodiesel from a feedstock containing at least one fatty acid, the process comprising:

(A) converting the at least one fatty acid in the feedstock to a glyceride;

(B) reacting the glyceride with at least one alcohol to produce a fatty acid alkyl ester wherein the reaction is conducted in a transesterification reactor and further wherein the at least one alcohol is added to the transesterification reactor at a rate that is greater than the stoichiometric amount of alcohol required for transesterification; and

(C) purifying the fatty acid alkyl ester by distillation or fractionation to produce purified biodiesel.

78. (Previously presented.) The process of Claim 77, wherein step (A) comprises mixing the feedstock with glycerin for a time sufficient to convert the at least one fatty acid in the feedstock to a glyceride.

79. (Previously presented.) The process of Claim 78, wherein the feedstock and glycerin is mixed at an elevated temperature in the absence of a catalyst.

80. (Previously presented.) The process of Claim 77, wherein step (B) comprises reacting the glyceride with the at least one alcohol in the presence of an alkali catalyst to produce glycerin and the fatty acid alkyl ester.

81. (Previously presented.) The process of Claim 78, wherein the glycerin is purified.

82. (Cancelled.)

83. (Previously presented.) The process of Claim 78, wherein the at least one

fatty acid in the feedstock is converted to a glyceride by adding glycerin to the feedstock while mixing and subjecting the admixture to reduced pressure.

84. (Previously presented.) The process of Claim 77, wherein prior to step (A) the feedstock is conditioned to remove solids.

85. (Previously presented.) The process of Claim 78, wherein the at least one fatty acid in the feedstock is converted to a glyceride in a glycerolysis reactor and further wherein glycerin is continuously added at a rate greater than the stoichiometric amount of glycerin required for glycerolysis.

86. (Previously presented.) The process of Claim 77, wherein the feedstock comprises at least one fatty acid at a concentration in the range of about 3 to about 97 percent by weight.

87. (Previously presented.) The process of Claim 85, wherein in step (A) glycerin is continuously added to the glycerolysis reactor at a rate in the range of about 110 percent to about 400 percent of the stoichiometric amount of glycerin required for glycerolysis.

88. (Previously presented.) The process of Claim 82, wherein in step (B) the alcohol is added at a rate equal to about 200 percent of the stoichiometric amount of alcohol required for transesterification.

89. (Previously presented.) The process of Claim 77, wherein the process is continuous.

90. (Currently amended.) A process for the production of biodiesel from glycerides comprising:

(A) reacting the glycerides with at least one alcohol to produce fatty acid esters and glycerin;

(B) separating a first liquid phase containing fatty acid alkyl esters and a second liquid phase containing glycerin to produce a fatty acid alkyl ester rich stream and a glycerin rich stream; and

(C) recovering a biodiesel containing the separated fatty acid alkyl esters.

91. (Previously presented.) The process of Claim 90, wherein the glycerides of step (A) are obtained by reacting a feedstock containing free fatty acids with glycerin.

92. (Previously presented.) The process of Claim 91, wherein the free fatty acids in the feedstock are reacted with glycerin in the absence of a catalyst.

93. (Previously presented.) The process of Claim 91, wherein the free fatty acids in the feedstock are reacted with glycerin in a glycerolysis reactor, wherein the amount of glycerin introduced into the reactor is a stoichiometric excess which is required to produce glycerides.

94. (Previously presented.) The process of Claim 90, wherein the glycerides are reacted with the at least one alcohol in the presence of an alkali catalyst.

95. (Cancelled.)

96. (Previously presented.) The process of Claim 95, further comprising purifying the fatty acid alkyl ester rich stream in a distillation or fractionation system.

97. (Previously presented.) The process of Claim 95, further comprising adjusting the pH of the glycerin rich stream to neutral and then purifying the neutralized stream by distillation or fractionation.

98. (Previously presented.) The process of Claim 91, wherein the reaction of the fatty acids in the feedstock and glycerin is conducted in at least two continuous stirred tank reactors.

99. (Previously presented.) The process of Claim 98, wherein the at least two reactors have a combined residence time of not more than about 500 minutes.

100. (Previously presented.) The process of Claim 90, wherein the at least one alcohol is a C₁-C₅ alcohol.

101. (Previously presented.) The process of Claim 90, wherein step (A) is conducted in at least two continuous stirred tank reactors.

102. (Previously presented.) The process of Claim 91, wherein the feedstock comprises free fatty acids at a concentration in the range of about 3 percent to about 97 percent by weight.

103. (Previously presented.) The process of Claim 91, wherein the feedstock is conditioned prior to reaction of the feedstock containing free fatty acids with glycerin.

104. (Previously presented.) The process of Claim 103, wherein the conditioned feedstock is a substantially uniform mixture of liquid lipids having a temperature in the range of about 35°C to about 250°C.

105. (Previously presented.) The process of Claim 90, wherein step (B) is conducted at a temperature in the range from about 150°C to about 250°C.

106. (Previously presented.) The process of Claim 94, wherein the alkali catalyst is selected from the group consisting of sodium hydroxide and potassium hydroxide.

107. (Previously presented.) The process of Claim 90, wherein step (A) is conducted at a temperature in the range from about 20°C to about 250°C.

108. (Previously presented.) The process of Claim 107, wherein step (A) is conducted at a temperature in the range from about 55°C to about 65°C.

109. (Previously presented.) The process of Claim 90, wherein step (A) is

conducted at an absolute pressure in the range of about 1 bar to about 250 bar.

110. (Previously presented.) The process of Claim 109, wherein step (A) is conducted at an absolute pressure of about 1 bar.

111. (Previously presented.) The process of Claim 95, wherein separation step (B) is based on the density difference between the first liquid phase and the second liquid phase.

112. (Previously presented.) The process of Claim 95, wherein the fatty acid alkyl ester rich stream is separated in a distillation or fractionation column into a bottoms fraction, an overhead fraction comprising primarily alcohol, and a side stream fraction comprising at least one fatty acid alkyl ester product.

113. (Previously presented.) The process of Claim 112, wherein the bottoms fraction comprises impurities, unsaponifiable materials, unreacted monoglycerides, unreacted diglycerides, unreacted triglycerides and fatty acids.

114. (Previously presented.) The process of Claim 112, wherein the fatty acid alkyl esters separated in the distillation or fractionation column meet ASTM specification D 6751.

115. (Previously presented.) The process of Claim 112, wherein the overhead fraction comprises essentially alcohol.

116. (Previously presented.) The process of Claim 112, wherein the distillation or fractionation column is operated at a pressure below about 2 pounds per square inch absolute.

117. (Previously presented.) The process of Claim 112, wherein the distillation or fractionation column is operated at a pressure in the range of about 0.1 pounds per square inch absolute to about 2 pounds per square inch absolute.

118. (Previously presented.) The process of Claim 112, wherein the distillation

or fractionation column is operated at a temperature in the range of about 180°C to about 280°C.

119. (Previously presented.) The process of Claim 118, wherein the distillation or fractionation column is operated at a temperature in the range of about 180°C to about 230°C.

120. (Previously presented.) The process of Claim 112, wherein the distillation or fractionation column contains a packing material.

121. (Previously presented.) The process of Claim 95, wherein the glycerin rich stream is purified by subjecting it to distillation.

122. (Previously presented.) The process of Claim 95, further comprising adjusting the pH of the glycerin rich stream by adding an acid solution thereto.

123. (Previously presented.) The process of Claim 122, wherein pH adjustment is performed using ion exchange media.

124. (Previously presented.) The process of Claim 100, wherein the C₁-C₅ alcohol is methanol.

125. (Currently amended.) A process for the production of biodiesel from glycerides comprising:

(A) reacting the glycerides with at least one alcohol to render an effluent stream containing fatty acid alkyl esters;

(B) purifying the fatty acid alkyl esters by distillation or fractionation; and

(C) recovering biodiesel containing the purified fatty acid alkyl esters

wherein a wet alcohol stream is recovered from the effluent stream.

126. (Previously presented.) The process of Claim 125, wherein step (A) is conducted in the presence of an alkali catalyst.

127. (Cancelled.)

128. (Currently amended.) The process of Claim ~~127~~ 125, wherein the wet alcohol stream is purified in a distillation or fractionation column to remove excess water therefrom.

129. (Previously presented.) The process of Claim 125, wherein the at least one alcohol is a C₁-C₅ alcohol.

130. (Previously presented.) The process of Claim 129, wherein the C₁-C₅ alcohol is methanol.

131. (Previously presented.) The process of Claim 125, wherein the process is continuous.

132. (Currently amended.) In a process for the production of biodiesel from glycerides wherein glycerides are reacted with an alcohol to produce fatty acid alkyl esters, the improvement comprising purifying the fatty acid alkyl esters by distillation or fractionation in a column operated at a pressure below about 2 pounds per square inch absolute.

133. (Cancelled.)

134. (Previously presented.) The process of Claim 133, wherein the distillation or fractionation is conducted in a column operated at a pressure in the range of about 0.1 pounds per square inch absolute to about 2 pounds per square inch absolute.

135. (Currently amended.) In a process for the production of biodiesel from glycerides wherein glycerides are reacted with an alcohol to produce fatty acid alkyl esters, the improvement comprising purifying the fatty acid alkyl esters by distillation or fractionation ~~The process of Claim 132, wherein the distillation or fractionation is conducted~~ in a column operated at a temperature in the range of about 180°C to about 280°C.

136. (Previously presented.) The process of Claim 135, wherein the distillation or fractionation is conducted in a column operated at a temperature in the range of about 180°C to about 230°C.

137. (Previously presented.) The process of Claim 132, wherein the distillation or fractionation is conducted in column containing a packing material.

138. (Previously presented.) A process for the production of biodiesel from glycerides comprising:

(A) reacting the glycerides with at least one alcohol to produce a liquid stream containing fatty acid alkyl esters and glycerin;

(B) separating a fatty acid alkyl ester rich stream and a glycerin rich stream from the liquid stream;

(C) adjusting the pH of the glycerin rich stream to neutral; and

(D) recovering biodiesel therefrom.

139. (Previously presented.) The process of Claim 138, wherein subsequent to step (C), the neutralized stream is purified.

140. (Previously presented.) The process of Claim 139, wherein the neutralized stream is purified by distillation or fractionation.

141. (Previously presented.) The process of Claim 138, wherein the glycerides of step (A) are obtained by reacting a feedstock containing free fatty acids with glycerin.

142. (Previously presented.) The process of Claim 141, wherein the free fatty acids in the feedstock are reacted with glycerin in the absence of a catalyst.

143. (Previously presented.) The process of Claim 138, wherein the glycerides are reacted with the at least one alcohol in the presence of an alkali catalyst.

144. (Previously presented.) The process of Claim 138, wherein the at least one alcohol is a C₁-C₅ alcohol.
145. (Previously presented.) The process of Claim 144, wherein the C₁-C₅ alcohol is methanol.
146. (Previously presented.) The process of Claim 138, wherein the pH is adjusted in step (C) by the addition of a mineral acid.
147. (Previously presented.) The process of Claim 146, wherein step (A) is conducted in the presence of an alkali catalyst and further wherein the mineral acid reacts with the alkali catalyst to render a precipitate and a precipitate-free permeate.
148. (Previously presented.) The process of Claim 147, wherein the precipitate is separated from the precipitate-free permeate by filtration.
149. (Previously presented.) The process of Claim 148, wherein prior to being separated from the precipitate-free permeate the precipitate is washed with methanol.
150. (Previously presented.) The process of Claim 147, wherein the precipitate-free permeate is further separated into a second fatty acid alkyl ester rich stream and a second glycerin rich stream.
151. (Previously presented.) The process of Claim 150, wherein the pH of the second glycerin rich stream is neutralized by the addition of caustic.
152. (Previously presented.) The process of Claim 146, wherein the mineral acid converts soaps formed in step (B) to free fatty acids.
153. (Previously presented.) The process of Claim 150, wherein the second fatty alkyl ester rich stream is combined with the separated fatty acid alkyl ester stream of step (B) to form a combined stream.

154. (Previously presented.) The process of Claim 153, wherein the combined stream is fractionated.

155. (Previously presented.) The process of Claim 151, wherein the alcohol and water in the neutralized second glycerin rich stream are separated from the glycerin.

156. (Previously presented.) The process of Claim 155, wherein the separated glycerin is further subjected to distillation or fractionation to remove high boiling impurities.

157. (Previously presented.) The process of Claim 156, wherein the resulting glycerin stream is decolorized.

158. (New.) The process of Claim 135, wherein the distillation or fractionation is conducted in column containing a packing material.